

Assessment of selected parameters of the nutritional status of patients undergoing surgery for colorectal cancers

Ocena wybranych parametrów stanu odżywienia chorych leczonych operacyjnie z powodu raka jelita

Konrad Zaręba¹, Kerianne Cummings², Justyna Dorf³, Seena Tabibi⁴, Sorcha McCrohan⁵, Bogusław Kędra¹

¹2nd Clinical Department of General, Gastroenterological, and Oncological Surgery, Medical University of Białystok, Białystok, Poland
Head of the Department: Prof. Bogusław Kędra

²Students' Scientific Association, 2nd Clinical Department of General, Gastroenterological, and Oncological Surgery, Medical University of Białystok, Białystok, Poland

Head of the Association: Konrad Zaręba MD, PhD

³Department of Clinical Laboratory Diagnostics, Medical University of Białystok, Białystok, Poland

Head of the Department: Prof. Joanna Matowicka-Karna

⁴Department of Pathology, The Johns Hopkins University School of Medicine, Baltimore, MD, USA

Head of the Department: Prof. Dr. Ralph Hruban

⁵Department of International Health, Georgetown University, Washington, USA

Head of the Department: Prof. Dr. Bernhard Liese

Medical Studies/Studia Medyczne 2022; 38 (3): 199–204

DOI: <https://doi.org/10.5114/ms.2022.119918>

Key words: colorectal cancer, body mass index, nutrition status, NRS2002.

Słowa kluczowe: rak jelita, wskaźnik masy ciała, stan odżywienia, NRS2002.

Abstract

Introduction: Colorectal cancer is one of the most common cancers of the gastrointestinal tract. The aetiopathogenesis of this neoplasm includes obesity, a sedentary lifestyle, a diet rich in fat and low in vegetables, smoking, alcohol consumption, and inflammatory bowel diseases. Available research raises concerns of malnutrition, or even cachexia, accompanying cancer or colorectal cancer.

Aim of the research: To evaluate the nutritional status of patients qualified for surgery due to colorectal cancer.

Material and methods: In this study, the authors analysed selected nutritional parameters and the severity of anaemia in 296 patients diagnosed with colorectal cancer. Data were collected upon admission to the 2nd Department of General and Gastrointestinal Surgery in University Clinical Hospital in Białystok, Poland and, retrospectively, with the help of correctly collected anamnesis.

Results: Based on body mass index (BMI) results, there was no evidence of malnutrition in the study group. Normal BMI values were found in 37% of respondents, while overweight or obesity was found in 63% of patients. Unintentional weight loss was observed in 167 patients and ranged from 2 to 15 kg. Hypoproteinaemia and hypoalbuminaemia were found in 35% of the examined patients. Anaemia occurred in 64% of the examined men and 52% of the examined women. In 70% of respondents abnormal total lymphocyte count (TLC) values were found, which indicated malnutrition. The NRS 2002 scale showed malnutrition in 60% of the respondents.

Conclusions: Malnutrition in patients with colorectal neoplasms seems to be underestimated. When assessing the nutritional status of patients, one should consider several parameters. BMI seems to be the parameter that is the least valuable and at the same time an overused indicator in everyday clinical practice.

Streszczenie

Wprowadzenie: Rak jelita grubego jest jednym z najczęstszych nowotworów przewodu pokarmowego. W etiopatogenezie tego nowotworu wymienia się: otyłość, siedzący tryb życia, dietę bogatą w tłuszcza, ubogą w warzywa, palenie tytoniu i alkohol, a także nieswoiste choroby zapalne jelit. W dostępnym piśmiennictwie coraz częściej podnosi się problem niedożywienia lub też wyniszczenia, które towarzyszą chorobie nowotworowej.

Cel pracy: Ocena stanu odżywienia chorych kwalifikowanych do leczenia operacyjnego z powodu raka jelita grubego.

Materiał i metody: Badaniem objęto 296 chorych operowanych z powodu raka jelita grubego i odbytnicy w II Klinice Chirurgii Ogólnej, Gastroenterologicznej i Onkologicznej Uniwersytetu Medycznego w Białymstoku. Miało ono charakter retrospektywny. Oceniano wybrane parametry stanu odżywienia, takie jak wskaźnik masy ciała (BMI), całkowita liczba limfocytów (CLL), niezamierzona utrata masy ciała, skala NRS 2002, poziom białka całkowitego i albuminy oraz obecność anemii.

Wyniki: Na podstawie wyników wartości BMI nie stwierdzono w badanej grupie obecności chorych z cechami niedożywienia. U 37% badanych wykazano prawidłowe wartości BMI, natomiast u 63% badanych nadwagę lub otyłość. Niezamierzoną utratę masy ciała zaobserwowano u 167 chorych i wynosiła ona od 2 do 15 kg. U 35% badanych stwierdzono hipoproteinemię i hypoalbuminemię. Niedokrwistość występowała u 64% badanych mężczyzn i 52% badanych kobiet. U 70% pacjentów wykazano nieprawidłowe wartości CLL, które świadczyły o niedożywieniu. Według skali NRS 2002 stwierdzono niedożywienie u 60% badanych.

Wnioski: Problem niedożywienia u chorych z nowotworami jelita grubego i odbytnicy wydaje się niedoszacowany. Oceniając stan odżywienia pacjentów, powinno się brać pod uwagę co najmniej kilka parametrów. Wskaźnik masy ciała okazuje się parametrem, który jest najmniej wartościowym, a jednocześnie nadmiernie używanym wskaźnikiem w codziennej praktyce klinicznej.

Introduction

Tumours of the colon and rectum are the fourth most common cause of cancer death in the world. Their incidence increases after the 5th decade of life. It is the 4th most common cancer in the male population and the 3rd most common in the female population [1, 2]. Histopathologically, 95% of colorectal cancers are adenocarcinomas [1]. Most of the changes are de novo changes, meaning that the majority are spontaneous and only 5% are genetic [1, 3]. The aetiological factors include obesity, a sedentary lifestyle, a diet rich in fat and low in vegetables, smoking, and alcohol consumption. Inflammatory bowel diseases are other predisposing factors to this neoplasm [1, 3–5]. For many years, a much higher incidence of colorectal cancer has been observed in industrialized countries such as Japan, the United States of America, Canada, and European countries [1, 5, 6].

Malnutrition is one of the consequences of cancer. It is found not only in the case of gastrointestinal neoplasms but also cancer of the oesophagus, pancreas, and stomach, and intestinal and rectal cancer. Malnutrition can also be found in ovarian cancer, larynx cancer, and lung cancer [6–8].

Currently, many different parameters and scales are used to assess nutritional status. The easiest to use are body mass index (BMI), assessment of unintentional weight loss, serum albumin and protein levels, severity of anaemia, total lymphocyte count (TLC), nutrition risk screening 2002 scale (NRS 2002 scale), and subjective global assessment (SGA) [1, 6–8]. Many reports emphasize the impact of nutritional status on the effectiveness and quality of treatment of patients [6, 7].

Aim of the research

The aim of the study was to evaluate the nutritional status of patients qualified for surgery due to colorectal cancer.

Material and methods

The study was retrospective. It included 296 surgical patients at the 2nd Department of General, Gastroenterological, and Oncological Surgery of the Medical University of Białystok in 2005–2010. This group included 121 women and 175 men. The average age

of the respondents was 64 years, with the youngest respondent being 28 and the oldest 95.

According to the TNM classification, the stage of disease advancement in the studied patients ranged from I to III. Thirteen patients were classified as having stage 1 colorectal cancer, 139 classified as having stage 2, and 144 patients were classified as having stage 3 colorectal cancer.

The study was based on the analysis of clinical data such as the following:

- BMI – determined according to the formula: body weight/height in metres squared, where the result < 18.49 kg/m² indicates underweight, normal body weight ranges between 18.5 and 24.99 kg/m², overweight is a result between 25 and 29.99 kg/m², and a BMI over 30 kg/m² constitute obesity (I, II, and III degree of obesity),
- worsening weight loss before hospitalization (absent, malnutrition – loss less than 10% body weight in the last 6 months, cachexia – loss of more than 10% of body weight in the last 6 months),
- the level of total protein and albumin in the blood serum (malnutrition was diagnosed at albumin levels below 3.5 g/dl and total protein levels below 5.5 g/dl),
- the presence of anaemia and its possible worsening or decline,
- total lymphocyte count TLC = % lymphocytes × lymphocyte count/100. Values below 1500 in 1 mm³ may be a sign of malnutrition.

Interpretation of CLL with reference to the state nutrition (according to De Chicco): light. Malnutrition between 1200 and 1499, moderate malnutrition between 800 and 1199, and wasting less than 800.

The study also considered the results obtained from the NRS 2002 scale, which assesses the deterioration of nutritional status and the severity of the disease.

Results

Results of the BMI assessment in the study group

Based on the BMI assessment alone, there were no patients who were underweight in the study group. In 37% of cases (109 patients), the BMI values were normal, while 63% (186 patients) of cases were overweight or obese. The patients with abnormal BMI values comprised 109 men and 71 women (Figure 1).

Assessment of unintentional weight loss

Over 57% of men (99 people) and 57% of women (68 people) experienced a decrease in body weight in the preoperative period (Figure 2). It averaged about 8 kg body weight (2 to 15 kg) over a period of 1 to 5 months. The greatest number of cases of weight loss was found in the groups with stage III and IV of the disease, and it was about 30% ($n = 88$) of the respondents. In stage II the percentage of weight loss was about 26% ($n = 76$). However, in the case of stage I, only about 2% ($n = 6$) of the respondents had weight loss with values ranging from 2 to 5 kg (Figure 2).

Serum albumin and total protein values

After analysing the level of total protein and albumin, 35% ($n = 104$) of the examined patients were diagnosed with hypoproteinaemia and hypoalbuminaemia. There were no differences in the sex of the studied patients. Both hypoproteinaemia and hypoalbuminaemia occurred only in the group of patients with stages II, III, and IV of the disease severity according to the TNM classification. Hypoproteinaemia and hypoalbuminaemia were found in 45% ($n = 62$) of patients with stage II and in 60% ($n = 86$) of patients with stage III/IV of bowel cancer (Figure 3).

Assessment of the prevalence of anaemia

After analysing the levels of hemoglobin (HGB), red blood count (RBC), and hematocrit (HCT), 64% of the examined men and 52% of the examined women were diagnosed with anaemia of varying severity. The incidence of anaemia and its severity correlated with the severity of the underlying disease. In stage III/IV, anaemia was observed in 62% ($n = 89$) of patients, in stage II of cancer this percentage was 52% ($n = 72$), while in early disease (stage I) anaemia was found in only 16% ($n = 2$) of patients.

Total lymphocyte count

Another parameter assessed was the total number of lymphocytes. Almost 70% ($n = 207$) of the respondents had incorrect values that could indicate malnutrition. TLC values indicating mild malnutrition were found in 52 patients, moderate malnutrition in 135 patients, and 20 patients were debilitated (Figure 4).

Nutrition Risk Screening 2002 scale

The results obtained after completing the NRS2002 scale by the patients were analysed as another parameter of the nutritional status assessment. In the case of point 2, i.e. disease severity/increased demand, all patients received 2 points due to the surgical procedure, and patients over 70 years of age also received an additional point due to their age. None of the examined patients received any points due

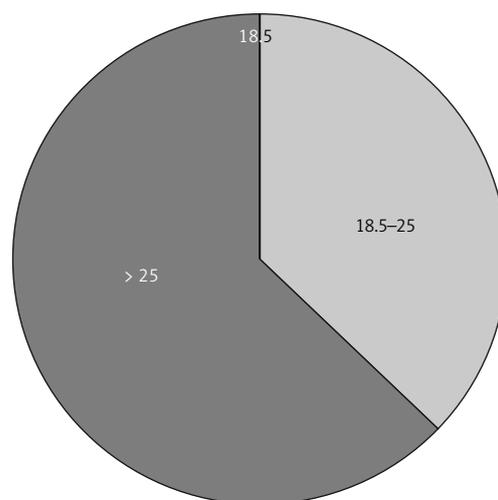


Figure 1. Body mass index (BMI) count

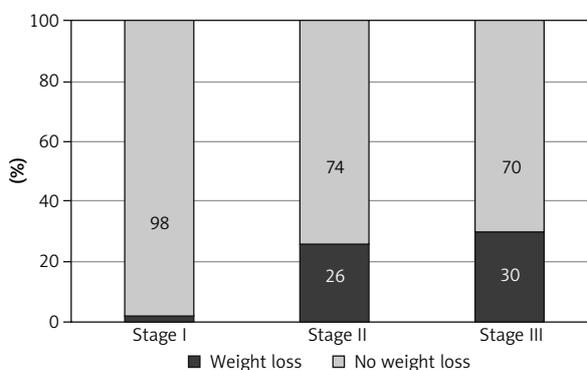


Figure 2. Assessment of unintentional weight loss

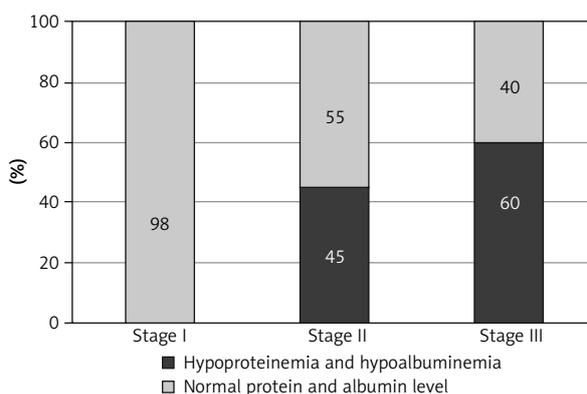


Figure 3. Serum albumin and total protein values

to BMI – all subjects had normal or elevated values of the BMI index. On the other hand, the NRS scale also considers the amount of weight loss during the last 1–3 months and/or the recent decrease in food consumption. Therefore, a result above 3 points (nutritional treatment indicated) was obtained in about 60% of the respondents. Moreover, we found that in

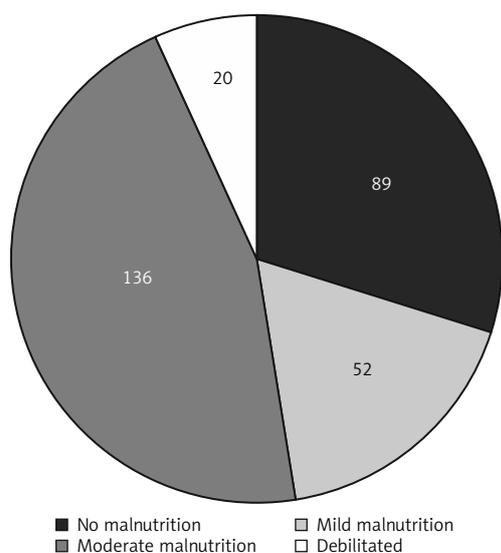


Figure 4. Total lymphocyte count

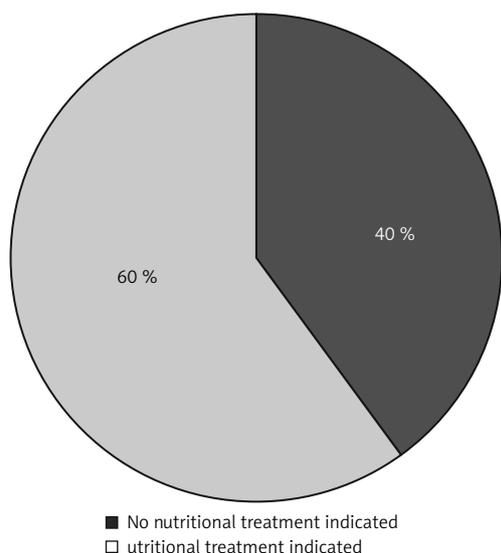


Figure 5. Nutritional treatment indicated (nutrition Risk Screening 2002 scale)

a significant proportion of the respondents, the point concerning the percentage decrease in the amount of food consumed seems to be irrelevant because most of the patients had no observation of this (Figure 5).

BMI and other parameters of malnutrition

From preliminary observations, it can be unequivocally stated that BMI is a mediocre indicator of the nutritional status of patients with gastrointestinal neoplasms. BMI indicating overweight or obesity was found in 63% of respondents. At the same time, after analysing other indicators of the nutritional status assessment, this group showed both anaemia, hypoalbuminaemia, hypoproteinaemia, and a clear decrease

in body weight. Anaemia occurred in about 60% of patients, weight loss was observed in about 46% of patients, while hypoproteinaemia and hypoalbuminaemia were diagnosed in 36% of patients.

Discussion

The issue of malnutrition among patients with gastrointestinal neoplasms is now a frequently discussed topic [1, 6, 7]. According to ESPEN, malnutrition is “a condition resulting from a lack of intake or absorption of nutrients, leading to a change in body composition, impairment of physical and intellectual function of the body, and adversely affecting the treatment of the underlying disease”. There are three main types of malnutrition: kwashiorkor, marasmus, and mixed type. Marasmus results from the intake of an insufficient amount of protein and calories, while kwashiorkor provides the correct or similar number of calories in the diet, with a simultaneous protein deficiency [9, 10].

Most of the available reports suggest a relationship between the frequency and severity of malnutrition and the location of the primary lesion [1, 6, 11–17]. In about 60–80% of patients with oesophageal cancer, about 60% of patients with gastric cancer, and about 30–40% of patients with diagnosed colorectal cancer, malnutrition occurs. More and more reports appear in which researchers prove that the nutritional status, or rather severe malnutrition, has a negative impact on the prognosis of neoplastic disease have come to light [11–17].

It is related to both the mental and physical tolerance of the patient to the proposed treatment (the extent of surgery, chemotherapy, and radiotherapy). At the same time, malnutrition may be responsible for the intensification of complications after the treatment; for example, a prosaic thing such as extending hospitalization time also had a significant impact on the survival time [7, 8, 18, 19]. In the above study, the authors, based on the review of their own material, state that malnutrition in patients with colorectal cancer seems to be underestimated in 30–40% of patients in literature reports vs. about 60% (depending on the assessment method used) of patients in the study group [1, 6, 20]. At the same time, we can confirm the problem of the insignificant value of the nutritional status assessment indicator, i.e. BMI, which is commonly noted in the literature and underestimated in everyday clinical practice. After analysing our own material, in a group of 296 patients, we did not find a single patient with a BMI that could indicate malnutrition; however, in 63% of respondents, malnutrition or even obesity was diagnosed, but after considering other factors such as weight loss, TLC, albumin, and total protein levels, a large percentage of these patients met the criteria for malnutrition or cachexia, which was consistent with the observation of other research-

ers. The NRS 2002 scale may be an objective indicator of malnutrition. However, this has drawbacks related to the assessment of BMI as well as the assessment of the quantitative decrease in food intake. In such cases, such a decrease is particularly noticeable in patients with neoplasms of the upper gastrointestinal tract and is very often associated with stenosis. In cases of tumours of the lower gastrointestinal tract, patients notice changes in dietary consumption very late. The studies also confirmed the desirability of assessing the level of albumin and total protein, TLC, and anaemia as indicators of the nutritional status of the organism [21–24]. In the case of the albumin level, it is important to remember about its decrease not only in malnutrition, but also about the concept of “negative acute phase index”. At the same time, we can confirm the thesis that there is no “golden mean” in the assessment of the nutritional status of the organism, but only a balanced list of many indicators that are taken together to give us a proper assessment of the nutritional status of the patient.

Based on the above results, which showed an underestimation of the incidence of malnutrition in patients with colorectal cancer, the authors are currently examining the impact of neoplastic disease on the state of metabolic disorders in patients with colorectal cancer. In this study, in addition to the impact on the nutritional status, we also assessed the parameters of oxidative stress and postoperative complications.

Conclusions

The problem of malnutrition in patients with colorectal neoplasms seems to be underestimated. When assessing the nutritional status of patients, one should consider several parameters. BMI seems to be the parameter that is the least valuable and is simultaneously an overused indicator in everyday clinical practice.

Conflict of interest

The authors declare no conflict of interest.

References

- Daniele A, Divella R, Abbate I, Casamassima A, Garri-si VM, Savino E, Casamassima P, Ruggieri E, Luca RDE. Assessment of nutritional and inflammatory status to determine the prevalence of malnutrition in patients undergoing surgery for colorectal carcinoma. *Anticancer Res* 2017; 37: 1281-1287.
- Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics 2002. *Cancer J Clin* 2002; 55: 74-108.
- Kwak EL, Chung DC. Hereditary colorectal cancer syndromes: an overview. *Clin Colorectal Cancer* 2007; 6: 340-344.
- Cepowicz D, Zaręba K, Pryczynicz A, Dawidziuk T, Żurawska J, Hołody-Zaręba, Gryko M, Kędra B. Blood serum levels of E-cadherin in patients with colorectal cancer. *Gastroenterology Rev* 2017; 12: 186-191.
- Piskor B, Pryczynicz A, Lubowicka E, Miniewska K, Zin-czuk J, Zareba K, Guzinska-Ustymowicz. Immunohisto-chemical expression of Fascin-1 in colorectal cancer in relation to clinical and pathological parameters. *Folia Hi-stochem Cytobiol* 2018; 56: 106-112.
- Ziętarska M, Krawczyk-Lipiec J, Kraj L, Zaucha R, Mał-gorzewicz S. Nutritional status assessment in colorectal cancer patients qualified to systemic treatment. *Contemp Oncol* 2017; 21: 157-161.
- Thoresen L, Frykholm G, Lydersen S, Ulveland H, Bara-cos V, Birdsell L, Falkmer U. The association of nutritional assessment criteria with health-related quality of life in patients with advanced colorectal carcinoma. *Eur J Cancer Care* 2012; 21: 505-516.
- Gupta D, Lis CG, Granick J, Grutsch JF, Vashi PG, Lam-mersfeld CA. Malnutrition was associated with poor quality of life in colorectal cancer: a retrospective analysis. *J Clin Epidemiol* 2006; 59: 704-709.
- Stratton RJ, Green CJ, Elia M. Scientific criteria for defini-ng malnutrition. In: *Disease Related malnutrition: an Evidence-based Approach and Treatment*. 1st edn. CAB International Cambridge 2003. 1-34.
- Barton RG. Nutrition and support in clinical illness. *Nutr Clin Pract* 1994; 9: 127-139.
- Fukuda Y, Yamamoto K, Hirao M, Nishikawa K, Maeda S, Haraguchi N, Miyake M, Hama N, Miyamoto A, Ikeda M, Nakamori S, Sekimoto M, Fujitani K, Tsujinaka T. Prevalence of malnutrition among gastric cancer patients undergoing gastrectomy and optimal preoperative nutritional support for preventing surgical site infections. *Ann Surg Oncol* 2015; 22: 778-785.
- Laviano A, Mequid MM, Inui A, Muscaritoli M, Rossi-Fa-nelli F. Therapy insight: cancer anorexia-cachexia syndrome-when all you can eat is yourself. *Nat Clin Pract Oncol* 2005; 2: 158-165.
- Riedel B, Ismail H, Findlay M, Ryan R. Nutritional status and fitness in neoadjuvant chemoradiation for oesopha-gogastric cancer. *Cancer Forum* 2011; 35: 170-175.
- Bower MR, Martin RC 2nd. Nutritional management during neoadjuvant therapy for esophageal cancer. *J Surg Oncol* 2009; 100: 82-87.
- Fearon K, Arends J, Baracos V. Understanding the mecha-nisms and treatment options in cancer cachexia. *Nat Rev Clin Oncol* 2013; 10: 90-99.
- Vincent A, Herman J, Schulick R, Hruban RH, Goggins M. Pancreatic cancer. *Lancet* 2011; 378: 607-720.
- Argilés JM. Cancer-associated malnutrition. *Eur J Oncol Nurs* 2005; 9 Suppl 2: S39-S50.
- Ihara K, Yamaguchi S, Shida Y, Ogata H, Domeki Y, Okamoto K, Nakajima M, Sasaki K, Tsuchioka T, Kato H. Poor nutritional status before and during chemotherapy leads to worse prognosis in unresectable advanced or recurrent colorectal cancer. *Int Surg* 2015; 17: 67-71.
- Blauwhoff-Buskermolen S, Versteeg KS, de van der Schu-eren MA, den Braver NR, Berkhof J, Langius JAE, Ver-heul HMW. Loss of muscle mass during chemotherapy is predictive for poor survival of patients with metastatic colorectal cancer. *J Clin Oncol* 2016; 22: 1339-1344.
- Pan YP, Chang PH, Fan CW, et al. Relationship between pre-treatment nutritional status, serum glutamine, arginine levels and clinicopathological features in Taiwan colorectal cancer patients. *Asia Pac J Clin Nutr* 2015; 24: 598-604.

21. Nazha B, Moussaly E, Zaarour M, Weerasinghe C, Azab B. Hypoalbuminemia in colorectal cancer prognosis: nutritional marker or inflammatory surrogate? *World J Gastrointest Surg* 2015; 7: 370-377.
22. Walsh D, Mahmoud F, Barna B. Assessment of nutritional status and prognosis in advanced cancer: interleukin-6, C-reactive protein, and the prognostic and inflammatory nutritional index. *Support Care Cancer* 2003; 11: 60-62.
23. Deans DA, Wigmore SJ, Gilmour H. Expression of the proteolysis-inducing factor core peptide mRNA is up-regulated in both tumour and adjacent normal tissue in gastro-oesophageal malignancy. *Br J Cancer* 2006; 94: 731-736.
24. Mantovani G, Macciò A, Lai P. Cytokine activity in cancer-related anorexia/cachexia: role of megestrol acetate and medroxyprogesterone acetate. *Semin Oncol* 1998; 25 (2 Suppl 6): 45-52.

Address for correspondence:

Konrad Zaręba MD, PhD
2nd Clinical Department of General,
Gastroenterological, and Oncological Surgery
Medical University of Białystok
M. Skłodowskiej-Curie 24a
15-276 Białystok, Poland
Phone: +48 857 468 287
E-mail: konrad.zareba@umb.edu.pl, nikt00@gazeta.pl